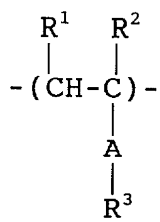
WHAT IS CLAIMED IS:

1. An ion conductor structural body having a high ion conductivity and an excellent mechanical strength, principally comprising (a) a polymer matrix, (b) a solvent capable of functioning as a plasticizer and (c) an electrolyte, wherein said polymer matrix (a) comprises a polymer chain having at least a segment represented by the following general formula (1), a main chain portion of said polymer chain and a side chain portion of said segment have an orientation property, and said polymer matrix has a crosslinked structure.



---- (1)

(wherein R^1 and R^2 are respectively H or an alkyl group of 2 or less carbon atoms, A is a group having at least a polyether group, and R^3 is a group having at least a alkyl group of more than 6 carbon atoms.)

2. An ion conductor structural body according to claim 1, wherein R^3 in the general formula (1) is a straight chain alkyl group of 6 to 22 carbon atoms or a alkyl benzyl group having a straight chain alkyl group of 6 to 22 carbon atoms.

3. An ion conductor structural body according to claim 1, wherein R^3 in the general formula (1) is a straight chain alkyl group of 8 to 18 carbon atoms.

4. An ion conductor structural body according to claim 1, wherein A in the general formula (1) is a group containing at least a group selected from the group consisting of $-(CH_2\text{-}CH_2\text{-}O)_n-$, $-(CH_2\text{-}CH(CH_3)\text{-}O)_n-$, and $-(CH_2\text{-}CH_2\text{-}O)_m-(CH_2\text{-}CH(CH_3)\text{-}O)_n-$ (wherein m and n are respectively a positive integer).

5. An ion conductor structural body according to claim 1, wherein A in the general formula (1) is a group containing at least $-(CH_2\text{-}CH_2\text{-}O)_n-$ (wherein n = 2 to 100).

6. An ion conductor structural body according to claim 1, wherein A in the general formula (1) is a group containing at least $-(CH_2\text{-}CH_2\text{-}O)_n-$ (wherein n = 5 to 30).

7. An ion conductor structural body according to claim 1, wherein a ratio between the polyether group of A and the alkyl group of R^3 is in a range of 0.05 to 3.0 in terms of a ratio of a molecular weight of the alkyl group of R^3/a molecular weight of the polyether group of A.

8. An ion conductor structural body according to claim 1, wherein a ratio between the polyether group of A and the alkyl group of R^3 in a range of 0.1 to 1.0 in terms of a ratio of a molecular weight of the alkyl group of R^3/a molecular weight of the polyether group of A.

9. An ion conductor structural body according to claim 5 or 6, wherein a ratio between the group $-(CH_2\text{-}CH_2\text{-}O)_n-$ of A and the alkyl group of R^3 is in a range of 0.05 to 10 in terms a ratio of the number of carbon atoms of the alkyl group of R^3 /the number of the n of the group $-(CH_2\text{-}CH_2\text{-}O)_n-$ of A.

10. An ion conductor structural body according to claim 5 or 6, wherein a ratio between the group $-(CH_2\text{-}CH_2\text{-}O)_n-$ of A and the alkyl group of R^3 is in a range of 0.5 to 5.0 in terms of a ratio of the number of carbon atoms of the alkyl group of R^3 /the number of the n of the group $-(CH_2\text{-}CH_2\text{-}O)_n-$ of A.

11. An ion conductor structural body according to any of claims 1 to 10, wherein said polymer matrix (a) contains at least a segment represented by the following general formula (2).

$$
\begin{array}{ccc}
R^3 & & R^4 \\
| & & | \\
-(CH & - & C)- \\
 & & | \\
 & & B
\end{array}
\qquad \text{----} \; (2)
$$

(wherein R^3 and R^4 are respectively H or an alkyl group of 2 or less carbon atoms, and B is a group containing at least a polar group selected from the group consisting of polyether group, cyano group, amino group, amido group and carbonate group.)

12. An ion conductor structural body according to claim 11, wherein B in the general formula (2) is a group containing at least a group selected from the group consisting of $-(CH_2-CH_2-O)_n-Z$, $-(CH_2-CH(CH_3)-O)_n-Z$, $-(CH_2-CH_2-O)_m-(CH_2-CH(CH_3)-O)_n-Z$, $-(CH_2-CH(CH_3)-O)_m-(CH_2-CH_2-O)_n-Z$, $-(CH_2-CH_2-O)_k-(CH_2-CH(CH_3)-O)_m-(CH_2-CH_2-O)_n-Z$, and $-(CH_2-CH(CH_3)-O)_k-(CH_2-CH_2-O)_m-(CH_2-CH(CH_3)-O)_n-Z$ (wherein k, m and n are respectively a positive integer, and Z is H or an alkyl group of 1 to 4 carbon atoms).

13. An ion conductor structural body according to claim 11, wherein B in the general formula (2) is a group containing at least $-(CH_2-CH_2-O)_n-Z$ (wherein n = 2 to 100, and Z is H or an alkyl group of 1 to 4 carbon atoms).

14. An ion conductor structural body according to claim 1, wherein said side chain portion of said segment has an orientation direction which is perpendicular to that of said main chain portion of said polymer chain.

15. An ion conductor structural body according to claim 1, wherein said ion conductor structural body has an anisotropic ion conductivity.

16. An ion conductor structural body according to claim 1, wherein said solvent (b) is a solvent capable functioning as a plasticizer which plasticizes said polymer matrix.

17. An ion conductor structural body according to claim 1, wherein said solvent is a nonprotic polar solvent.

18. An ion conductor structural body according to claim 17, wherein said nonprotic polar solvent comprises one or more solvents selected from the group consisting of ethers, carbonates, nitriles, amides, esters, nitro compounds, sulfur compounds, and halogen compounds.

19. An ion conductor structural body according to claim 1, wherein said electrolyte is a lithium salt.

20. An ion conductor structural body according to claim 1, wherein said ion conductor structural body includes a retaining material comprising at least one kind of a material selected from the group consisting of a powdery resin material, a powdery glass material, a powdery ceramic material, a nonwoven fabric and a porous film.

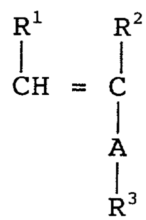
21. An ion conductor structural body according to claim 20, wherein the content of said retaining material in the ion conductor structural body is in a range of 1 to 50 wt.% versus the sum amount of the constituents of the ion conductor structural body.

22. A process for producing an ion conductor structural body comprising at least a polymer matrix, a solvent capable of functioning as a plasticizer and an

electrolyte, said process comprising the steps of:

(a) mixing (i) a monomer represented by the following general formula (3), (ii) a solvent and (iii) an electrolyte to obtain a mixture,

(b) subjecting said mixture to a polymerization treatment by way of polymerization reactionto form a polymer matrix as said ion conductor structural body.



---- (3)

(wherein R^1 and R^2 is respectively H or an alkyl group of 2 or less carbon atoms, A is a group containing at least a polyether group, and R^3 is a group having at least an alkyl group of 6 or more carbon atoms.)

23. The process according to claim 22, wherein a polymerization initiator is admixed in said step (a).

24. The process according to claim 22, further comprising a step of forming a crosslinking structure in said polymer matrix by way of crosslinking reaction.

25. The process according to claim 24, wherein said crosslinking structure comprises a covalent bond.

26. The process according to claim 24, wherein a monomer capable forming a crosslinking structure is admixed

in said step (a).

27. The process according to claim 26, wherein said polymerization reaction in said step (2) includes crosslinking reaction.

28. The process according to claim 22, wherein R^3 in the general formula (3) is a straight chain alkyl group of 6 to 22 carbon atoms or an alkyl benzyl group having a straight chain alkyl group of 6 to 22 carbon atoms.

29. The process according to claim 22, wherein wherein R^3 in the general formula (3) is a straight chain alkyl group of 8 to 18 carbon atoms.

30. The process according to claim 22, wherein A in the general formula (3) is a group containing at least a group selected from the group consisting of $-(CH_2-CH_2-O)_n-$, $-(CH_2-CH(CH_3)-O)_n-$, and $-(CH_2-CH_2-O)_m-(CH_2-CH(CH_3)-O)_n-$ (wherein m and n are respectively a positive integer).

31. The process according to claim 22, wherein A in the general formula (3) is a group containing at least $-(CH_2-CH_2-O)_n-$ (wherein n = 2 to 100).

32. The process according to claim 22, wherein A in the general formula (3) is a group containing at least $-(CH_2-CH_2-O)_n-$ (wherein n = 5 to 30).

33. The process according to claim 22, wherein a ratio between the polyether group of A and the alkyl group of R^3 is in a range of 0.05 to 3.0 in terms of a ratio

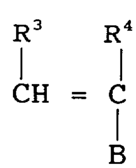
of a molecular weight of the alkyl group R^3 /a molecular weight of the polyether group of A.

34. The process according to claim 22, wherein a ratio between the polyether group of A and the alkyl group of R^3 is in a range of 0.1 to 1.0 in terms of a ratio of a molecular weight of the alkyl group of R^3 /a molecular weight of the polyether group of A.

35. The process according to claim 31 or 32, wherein a ratio between said $-(CH_2-CH_2-O)_n-$ group of A and the alkyl group of R^3 is in a range of 0.05 to 10 in terms of a ratio of the number of carbon atoms of the alkyl group of R^3 /the number of the n of the group $-(CH_2-CH_2-O)_n-$ of A.

36. The process according to claim 31 or 33, wherein a ratio between said $-(CH_2-CH_2-O)_n-$ group of A and the alkyl group of R^3 is in a range of 0.5 to 5.0 in terms of a ratio of the number of carbon atoms of the alkyl group of R^3 /the number of the n of the group $-(CH_2-CH_2-O)_n-$ of A.

37. The process according to claim 22, wherein a monomer represented by the following general formula (4) is admixed in said step (a).



---- (4)

(wherein R^3 and R^4 is respectively H or an alkyl group

of 2 or less carbon atoms, and B is a group having at least a polar group selected from the group consisting of polyether group, cyano group, amino group, amide group and carbonate group.)

38. The process according to claim 37, wherein B in the general formula (4) is a group containing at least a group selected from the group consisting of $-(CH_2-CH_2-O)_n-Z$, $-(CH_2-CH(CH_3)-O)_n-Z$, $-(CH_2-CH_2-O)_m-(CH_2-CH(CH_3)-O)_n-Z$, $-(CH_2-CH(CH_3)-O)_m-(CH_2-CH_2-O)_n-Z$, $-(CH_2-CH_2-O)_k-(CH_2-CH(CH_3)-O)_m-(CH_2-CH_2-O)_n-Z$, and $-(CH_2-CH(CH_3)-O)_k-(CH_2-CH_2-O)_m-(CH_2-CH(CH_3)-O)_n-Z$ (wherein k, m and n are respectively a positive integer, and Z is H or an alkyl group of 1 to 4 carbon atoms).

39. The process according to claim 37, wherein B in the general formula (4) is a group containing at least $-(CH_2-CH_2-O)_n-Z$ (wherein n = 2 to 100, and Z is H or an alkyl group of 1 to 4 carbon atoms).

40. The process according to claim 22, wherein the solvent (ii) is a solvent capable functioning as a plasticizer which plasticizes said polymer matrix.

41. The process according to claim 40, wherein said solvent is a nonprotic polar solvent.

42. The process according to claim 41, wherein said nonprotic polar solvent comprises one or more solvents

selected from the group consisting of ethers, carbonates, nitriles, amides, esters, nitro compounds, sulfur compounds, and halogen compounds.

43. The process according to claim 22, wherein the electrolyte (iii) is a lithium salt.

44. The process according to claim 22, wherein the polymerization reaction in the step (b) is polymerization reaction in which heat energy is utilized.

45. The process according to claim 22, further comprising a step of incorporating a retaining material comprising at least one kind of a material selected from the group consisting of a powdery resin material, a powdery glass material, a powdery ceramic material, a nonwoven fabric and a porous film into the ion conductor structural body.

46. The process according to claim 45, wherein the content of said retaining material in the ion conductor structural body is made to be in a range of 1 to 50 wt.% versus the sum amount of the constituents of the ion conductor structural body.

47. A rechargeable battery comprising an anode, a cathode and an ion conductor structural body provided between said anode and said cathode, said anode having a face which is opposed to a face of said cathode, wherein said ion conductor structural

body comprises an ion conductor structural body (i) which principally comprises a polymer matrix, a solvent capable of functioning as a plasticizer and an electrolyte, said polymer matrix comprising a polymer chain having at least a segment represented by the following general formula (1), a main chain portion of said polymer chain and a side chain portion of said segment having an orientation property, and said polymer matrix having a crosslinked structure, and said ion conductor structural body (i)is arranged such that an ion conductivity in a direction of connecting said face of said anode and said face of said cathode is increased.

$$
\begin{array}{c}
\begin{array}{ccc} & R^1 & R^2 \\ & | & | \\ -(& CH- & C)- \\ & & | \\ & & A \\ & & | \\ & & R^3 \end{array}
\end{array}
\quad \text{----} \; (1)
$$

(wherein R^1 and R^2 are respectively H or an alkyl group of 2 or less carbon atoms, A is a group having at least a polyether group, and R^3 is a group having at least a alkyl group of more than 6 carbon atoms.)

48. A rechargeable battery according to claim 47, wherein said anode or/and said cathode contain an ion conductor structural body.

49. A rechargeable battery according to claim

47, wherein said ion conductor structural body is an ion conductor structural body defined in any of claims 1 to 21.

50. A rechargeable battery according to claim 47, wherein said anode takes in lithium ion when discharge reaction is performed and releases said lithium ion when discharge reaction is performed.

51. A process for producing a rechargeable battery comprising an anode, a cathode and an ion conductor structural body provided between said anode and said cathode, said anode having a face which is opposed to a face of said cathode, characterized by including a step of arranging a ion conductor structural body according to claim 1 such that an ion conductivity in a direction of connecting said face of said anode and said face of said cathode is increased.

52. The process according to claim 51, further including a step of forming said ion conductor structural body on said anode or/and said cathode and arranging the anode and the cathode so as to oppose to each other.

53. The process according to claim 51, further including a step of forming said anode to contain said ion conductor structural body or/and a step of forming said cathode to contain said ion conductor structural body.

54. The process according to claim 53, wherein a solution containing at least one kind of a material selected

from the group consisting a polymer, a monomer and an oligomer which are capable of being starting materials for forming a polymer matrix of said ion conductor structural body is impregnated in an active material layer of said anode or/and an active material layer of said cathode and said polymer matrix is formed in said active material layer of said anode or/and said active material layer of said cathode.

55. The process according to claim 54, wherein the formation of said ion conductor structural body is performed by way of polymerization reaction or/and crosslinking reaction.

56. The process according to claim 53, wherein said anode or/and said cathode are formed by admixing said ion conductor structural body in an active material and disposing said active material on a collector.